M2 Bradley during field experiment.

55th Signal Company (Aaron Robert Kughen)

Joint Experimentation: A Necessity for Future War

By MARK A. JOHNSTONE, STEPHEN A. FERRANDO, *and* ROBERT W. CRITCHLOW

We are told that necessity is the mother of invention. But invention can be the mother of necessity when it comes to military adaptation to technological advances. New technologies in the hands of an enemy may require either adjustment or accepting defeat. They can also generate political pressure for adoption and innovation. Due to the demands of the information revolution and the goals set forth in *Joint Vision 2010*, the U.S. military again confronts the need to adapt.

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Innovation requires adjustment not only in technology but in doctrine and organization. History presents examples of test-bed units that became templates for the future. Today a joint experimentation organization could provide a technique for minimizing overlap and interservice rivalry, sharing ideas, and developing the force to fulfill *JV 2010*.

Three options are at work or under consideration. First, some services have established their own "battlelabs" to test technologies and concepts. Second, the Secretary of Defense has designated U.S. Atlantic Command (ACOM) the executive agent for joint experimentation. Third, Senator Dan Coats and others have proposed a separate unified command for experimentation and doctrine development. Given current resource constraints, the ACOM solution is the most prudent first step in experimenting with future concepts.

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55th Signal Company (Russell J. Good)

High mobility artillery rocket system.

The Imperative for Innovation

The driving force behind today's call for military change is as common as beach sand: silicon. Whether or not the microchip and associated communications technologies have produced a revolution in military affairs (RMA) to which the Armed Forces must respond, the mandate for adaptation remains. *JV 2010* identifies information superiority as the key enabler behind leaner but more lethal forces. It will empower the military to react more quickly and cohesively, reduce the "fog of war," and allow friendly forces to disrupt enemy command and control.

Arthur Cebrowski and John Garstka depict how these information capabilities might combine to produce a synergy in their concept of "network-centric warfare". The joint force is interconnected through an information grid that provides the command and control back-plane that links all forces. Sensor grids use the information grid to feed targeting information to engagement grids. These grids then strike with precision and lethality more quickly than the enemy can react. Individual high value platforms, and thus individual service-specific competencies, become less critical on their own merit. The vital factor is the ability of sensors and shooters to interact quickly across the joint force, exploit information, and act in a highly synergistic fashion to produce maximum combat power.[1] The move to a force based on information superiority must also consider the integration of technology with the human factor, such as the risk of overloading future operators.

experimentation will reduce guesswork, and a broad approach that requires consensus building will minimize the risk

The problem that emerges is how to promote innovations that require change across service boundaries and competencies. A recent draft RAND Corporation report notes that the timeframe is an important factor. Near-term *era A* adaptation represents *evolution* of current service competencies and technologies and *era B* innovation posits a complete revolution in military doctrine, organization, and technology that fundamentally alters the way war is fought. Era A starts now and stretches to around the year 2010. It looks to the near and mid-term threats and uses existing technology to reduce present vulnerabilities. Exploiting emerging technology to minimize existing threats will enable reengineering the force to reduce personnel levels and costs while increasing capabilities. Essentially, we must effect greater lethality and power projection by blending emerging technology with a smaller, more deadly force. Era A changes fall within the purview of the services.[2]

Era B looks to *revolutionary* change in warfare beyond 2010. Due to the nature of new threats, era B should include experimentation with exotic concepts. Ideas such as speed-of-light theater missile defense, submarines with embarked land-attack capabilities, or space and unmanned aircraft are just some avenues to explore. The key distinction is that era B will present some threats that cannot currently be envisioned. That will call for hedging—cultivating organizations and specially skilled people to develop exotic concepts that could someday reorder service functions.

Looking at RMA in two separate but overlapping eras illuminates two points. First, the transformation of U.S. forces needs to be gradual but steady. It is not a path to recklessly charge down. Finding ways to use existing technology to defeat the near- and mid-term threats will take the collective effort by all the services with a single joint point of contact. Capitalizing on expertise in their specific roles and missions gives the services a vested interest and will ensure that quality advancements are not sacrificed for swift change.

Second, continued evolution of the force through era B will require testing a broad array of ideas and hedging on future needs. Experimentation will reduce guesswork, and a broad approach that requires consensus building will minimize the risk. Under this approach, we must sacrifice some efficiency for security. It is better to be slightly wrong in a number of overlapping

choices than to be vastly wrong about a single overarching technological bet.

Preparing for both eras A and B can cause friction in a resource-constrained environment. Choosing one or the other sacrifices near-term readiness or future capability. The national military strategy directs the services to "prepare now" to exploit RMA and maintain military superiority into the future. If "prepare now" is one of three major pillars of the national military strategy, it should receive commensurate resources. However, the services lack the capacity to prepare for both the near and long term and they are struggling with how to spend their limited money. Attention could be focused on present deficiencies solvable within the future years defense plan timeframe. Alternatively, funds could go to capabilities identified as essential in *JV 2010* or to concepts far beyond 2010.

At the same time caution is in order. The process of change must be deliberate and thoughtful. The United States must not search so aggressively for the "military after next" that it sacrifices its lead and endangers readiness during the transition.

Doctrinal development and organizational adaptation—which may threaten bureaucracies, traditions, and prerogatives—must accompany changes in technology for a military to fully realize the combat potential of new weapon systems. For example, in the 1870s the French military had the advantage of a precursor to the machine gun in their war against the Prussians, the Gatling-like *Mitrailleuse*. However, because it rode on a carriage like a cannon it was placed with the artillery rather than up with the infantry where it would have been able to better support combined arms operations. French organization had not adapted to new technology to its best advantage. In 1940, France had better tanks with larger guns and armor thicker than opposing German *Panzers* but limited their effectiveness by tying them to infantry support.

Test-Beds as Seed Beds

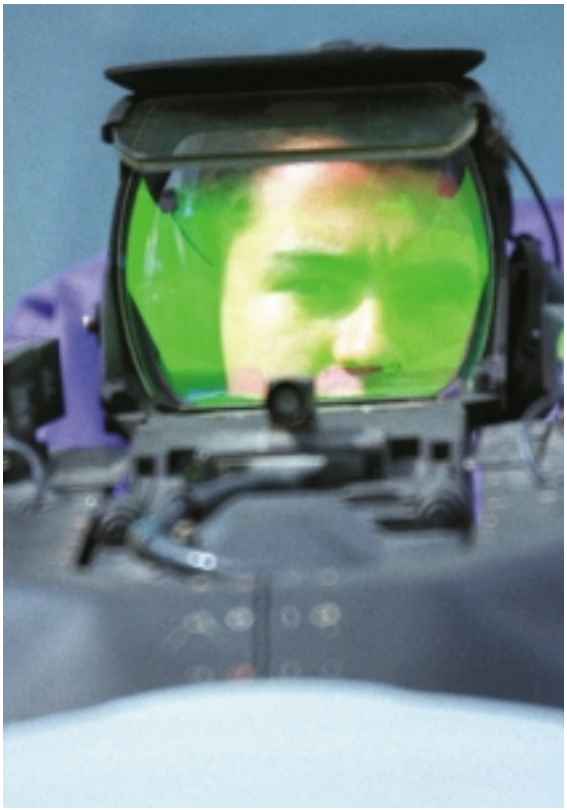
How can the Armed Forces prod doctrinal, organizational, and technological innovation to change how it fights? Historical examples of successful innovation point to dedicated test-bed organizations that provide a venue for integrating technology into the force, developing supporting organizations, and creating implementation doctrine in a forum that provides verification of ideas and mitigates the impact of wildcat schemes on the rest of the force.

The classic case of such test-beds is the integration of tanks and development of *Blitzkrieg* doctrine by General Heinz Guderian in the *Wehrmacht* before World War II. As early as 1928, Guderian, as a captain in the Inspectorate of Transport Troops, a logistics organization, conducted experiments with dummy tanks made from automobiles fitted with canvas covers. In combination with secret tests in Russia in the 1920s, these trials led to the concept of the *Panzer* division. In 1931 Guderian's organization was activated as the 3d (Prussian) Motorized Battalion, consisting of armored reconnaissance cars and dummy tanks, that permitted further development of combined arms doctrine. The reliance on dummy tanks was propitious. Germany did not produce its first tank until 1930, thus procurement decisions were deferred until they could be matched against doctrinal concepts. By 1935 the first improvised *Panzer* division was established for exercise purposes and the first corps was finally established with three divisions later that year. When war broke out, the Germans, supported by advanced combined arms doctrine and infiltration tactics, overran the French and forced the British into the sea at Dunkirk.

The German experience exploited several advantages. The pain of defeat in World War I and the forced reduction of their army placed a premium on innovation. Further, they already possessed a nascent combined-arms doctrine that needed only an armored force to reach fruition. Lastly, the *Panzer* force enjoyed political sympathy both in the operational concept and in support for mavericks like Guderian, who had a propensity to offend the established order.[3]

The U.S. Army enjoyed a similar period of innovation in the 1960s. In a stunning example of the rise of an operational concept perfect for its time, the Army established the 11th Air Assault Division to test helicopter mobility. That unit led to the 1st Cavalry Division (Airmobile), which played a critical role in the early years of American intervention in Vietnam. It also participated in wargames and field exercises to advance doctrine and organizational development. Further, it sent companies to Vietnam in 1964 and learned valuable combat lessons. Lastly, it created a base of officers experienced in integrating aviation into Army combat operations.[4]

As with the *Panzer* division, political support was key. Secretary of Defense Robert McNamara specifically directed the Army to explore helicopter mobility. His political support in turn sheltered airmobility advocates. Before that time aviation was a fringe community the Army saw as a support rather than combat arms element. By the end of the 1960s airmobility emerged as an indispensable combat concept.



U.S. Air Force (Delilah A. Castillo)

Monitoring laser calibration test.

The Army experiments with AirLand battle doctrine in the early 1980s found a home in the 9th Infantry Division High Technology Test-Bed. Established at Fort Lewis, this division tested technologies such as light armored vehicles, machine guns, lightweight antitank and antiaircraft weapons, and advanced command and control systems. The goal was to produce both doctrine and organizations to enable rapid worldwide crisis response via air transport.[5] The Army has since made rapid response a hallmark, as seen in Operations Just Cause and Desert Shield.

the space battlelab initiatives are likely to remain small scale and peripheral

Generally, test-beds enabled the examination and synthesis of doctrinal, organizational, and technological concepts. They also allowed experimentation without locking in specific systems for procurement and experimentation based on preexisting systems. They permitted development of officer expertise that later proved valuable throughout the force. And they often served as the basis for new combat-ready units that exploited new capabilities. But the test-beds often needed outside political support to survive and overcome bureaucratic service inertia. Nevertheless, they emerged as a critical method for promoting military innovation that might prove valuable today.

Competing Approaches

Different approaches have been proffered for dealing with innovation. At issue is the Nation's ability to meet threats during this era of technological revolution. At the far right on the spectrum is the status quo. Here four distinct services determine their future needs and take it upon themselves to ensure a modicum of interoperability, requiring only minor bureaucratic change. At the far left is a call for radical organizational change that might envision an eventual merging of the four services into one. These extremes have competing ideals, and pursuit of one can only take place at the expense of the other.

Both models for change have positive aspects. On the right, multiple services engage in service-specific roles and missions because no one service can conduct the complete spectrum of operations in every medium.[6] On the left, a single service efficiently manages a shrinking defense budget. On the far right, the current paradigm continues in hope that the acquisition system will support the pursuit of technology and experimentation to cover all aspects of warfare and achieve interoperability with other services. On the far left, radical change creates a joint forces command with the authority, forces, and resources to transform the military through joint experimentation.[7]

The Conservative Solution

Service-specific battlelabs represent the most conservative option. A typical service-specific program for promoting innovation is the Air Force Space Battlelab at Schriever Air Force Base. Established in 1997, it is chartered to "focus on innovative space operations and logistics concepts, quantify their potential for helping the Air Force fulfill its 'core competencies,' then test the concept in operational situations." Most of its attention goes to field level. A review of ongoing projects reveals that all are *Kenney*-level initiatives, named for General George Kenney of World War II fame and focusing on small tactical initiatives of moderate cost. Their charter enables the lab to address *Mitchell*-level initiatives, named for General Billy Mitchell, and dealing with large, costly, revolutionary concepts; but the space battlelab is not conducting any far-reaching experiments at present. The programs under study apply more to service-specific techniques and procedures such as color space-object identification and use of commercial telescopes to augment space surveillance .[8]

Limited Objective Experiment.

U.S. Marine Corps (David J. Ferrier)

The space battlelab initiatives are likely to remain small scale and peripheral. They have limited funding and manpower. Projects must be completed within 18 months. Further, ideas for battlelab testing are subjected to sanity checks by at a minimum of four review teams prior to approval. Such a process seems unlikely to impart a revolution to the joint force.

Service battlelabs do present advantages for near-term innovation. Given their service-specific orientation and manning, they are highly capable of exploiting service expertise in core competencies. Further, they dovetail with the legislated service missions to organize, train, and equip combat forces for the unified commanders. Thus they are an efficient means of promoting the evolutionary era A change described in the RAND Corporation report.

However, because of a limited focus, battlelabs advocate only service-specific innovation and may fall short on advancing ideas that cross service boundaries and enhance jointness. Further, because of limited resources and mandates, they are constrained to effecting change at the margins but not the revolutionary or era B innovations.

A variant on the concept that illustrates possible modifications for enhanced jointness is the Joint C^{4}ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) Battlelab or JCB, an example of the advantage gained by joint capabilities integration. JCB provides combatant commands on the JTF level with assessment and application integration and fosters rapid insertion of proven C^{4}ISR technologies on the combatant command level. Its relationship with the Joint Requirements Oversight Council (JROC) has given it exceptional leverage to institute changes across service boundaries.

Since its inception in 1996 JCB has made huge gains in ensuring that C^{4}ISR acquisitions are interoperable and has saved scarce procurement dollars. For example, it developed a process that allowed Navy and Air Force Link–16 messages and Army Link–17 messages to exchange data in real time. In addition, it has furthered interoperability across service solutions for asynchronous transmission mode communications, leading to a standardized system across the service lines and a cost savings. These successes illustrate how a joint battlelab is an important evolution and more versatile option than the purely service-owned battlelab. However, like the service battlelabs, JCB targets the 18–36 month timeframe for implementing solutions based on off-the-shelf capabilities rather than new technologies requiring a long-term perspective.

A Balancing Act

The middle ground solution is to appoint U.S. Atlantic Command as the executive agent for joint warfighting experimentation. The National Defense Panel identified the need for such an initiative to bring *JV 2010* to fruition. On May 15, 1998, the Secretary of Defense designated CINCLANT as the executive agent to "aggressively foster innovation and rapid fielding of new joint concepts and capabilities." Under the Secretary's charter, ACOM is responsible to CJCS "to explore new joint warfighting concepts and capabilities and determine doctrine, organization, training and education, material, leadership, and personnel (DOTMLP) implications for change. These experiments will support *JV 2010* and future joint warfighting visions." The validating authorities for DOTMLP changes were CJCS and/or JROC as appropriate until CINCLANT assumed the function.

The ACOM implementation plan (IPLAN) includes a process for taking a concept from an idea to DOTMLP. Concepts are received from multiple sources, translated into future operational capabilities, and prioritized. The joint experimentation campaign plan is published annually and translates concepts into objectives, including resourcing and scheduling. The plan is staffed with all key participants, validated by a board of directors, and approved by CINCLANT.

The primary source for experimentation will be forces over which ACOM has combatant command authority. The command can form JTFs to conduct joint experimentation as directed in the joint experimentation campaign plan. By forming mission specific JTFs, this plan will provide flexibility to the services and allows forces to focus on core competencies when not involved with joint experimentation. It also precludes permanently taking away forces to establish a standing JTF or assigning them directly to ACOM.

The ACOM implementation plan presents a balanced approach towards achieving *JV 2010* and future visions. It maintains the initiative and innovation of the service battlelabs that attack era A-type changes. It also allows for RMAs that may completely change the composition and viability of the military for era B changes. The intent is to use joint experimentation to identify the high-payoff areas for systems development to address current deficiencies, near-term capabilities, and future concepts alike.

Several compelling factors make ACOM an excellent choice for joint forces experimenter. First, it is the current joint forces integrator, trainer, and provider for 80 percent of DOD forces, active and Reserve. With these roles already in hand, the command will soon gain additional expertise by assuming command of the Joint Warfighting Center, Joint Warfare Analysis Center, Joint Command and Control Warfare Center, and Joint Battle Center.

Second, command service components are responsible for conducting service experiments. Including service expertise in the joint experimentation effort will synthesize diverse perspectives on experiments, assess concepts for service-unique capabilities, and enable effective coordination and control to ensure seamless coverage of the spectrum of military operations. Moreover, linking service and joint experimentation facilities and capabilities to create a "federation of battlelabs" will network service battlelabs and the Joint Battle Center into a virtual distributed network.

ACOM will coordinate the efforts of these service experimental organizations and provide a joint context. It will improve standardization in event design, execution, analysis, and reporting on experimentation. ACOM itself will only conduct 10 percent of joint experiments, relying on the services for the "heavy lifting." As the executive agent, it can take advantage of its resident expertise and complementary tasks and use its service components' expertise to ensure that the transformation is built upon diverse, quality, and safe experimentation.

Third, CINCLANT is a unified combatant commander. His area of responsibility has recently shrunk and become more benign. This change will permit proper focus on the newly acquired task of experimentation. As the joint forces provider, trainer, and integrator, CINCLANT will maintain an operational perspective when recommending the direction transformation should take. His warfighting orientation as a geographic CINC will ensure that the needs of the other combatant commanders receive due regard.

The middle-ground virtues of making ACOM responsible for joint experimentation could also endanger its success. Managing joint experimentation could imperil the warfighting focus of the CINC or become a neglected additional duty in a command swamped with crisis management.

The intent of the ACOM plan is to exploit existing exercises as opportunities for joint experimentation. This idea suffers from dangers of distraction. A JTF exercise built around joint experimentation risks reducing the instructional value of the event for troops whose training time is already constrained by operational deployment

Remote sentry unit used to track multiple targets.

55th Signal Company (Russell J. Good)

schedules. Alternatively, the exercise team may well treat the experimental events as distractions that are at best half-heartedly integrated and played in the scenario.

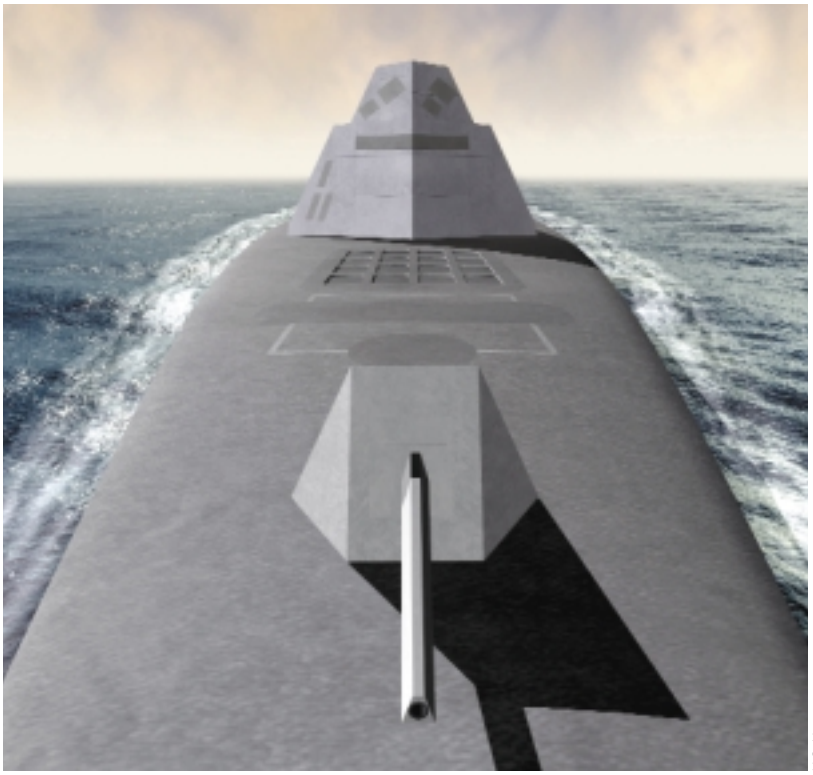
The key to ACOM success as the joint experimentation advocate will be cooperation from the services. This could prove to be the weakest link. The command can make recommendations to the services but will not have directive authority over DOTMLP. The services will need to support joint experimentation with funding and manpower from their battlelabs. They must also be willing to adopt the resulting innovations, which could include doctrinal or organizational changes that counter service traditions. Lack of such cooperation in previous efforts led to the ACOM initiative and could also be the command's downfall.

the key to ACOM success as the joint experimentation advocate will be cooperation from the services

JFC: Cleaning House

A JFC is the most radical option. It would take over service responsibilities for DOTMLP. The National Defense Panel recommended creating a JFC under a functional unified commander. It would be manned with forces detailed from the services, establish joint national training centers, and create a joint battlelab that reports directly to a CINC. According to the proposal, the panel did "not seek to limit individual service innovation in any way. . . . For example, the services would experiment with weapons systems . . . which once certified would be tested in the much broader joint arena."

The JFC option was outlined in legislation proposed by Senators Coats and Lieberman. A Title XXX would amend Title 10 to give sweeping authority to the joint force commander and his joint experimentation efforts. Title XXX would propose establishing a JFC as a unified combatant commander with two principal functions: to integrate



U.S. Navy

DD21 "Land Attack Destroyer" concept.

and provide ready joint forces based in the continental United States to other combatant commanders to carry out assigned missions; and to design, develop, and execute joint experimentation to determine the future capabilities, organization, and operational concepts of the joint force.

However, ACOM is already executing the first function for most CONUS-based forces. Therefore it is not revolutionary. The need for joint integration, training, and providing forces to other CINCs helped drive the unified command plan change that transferred the ACOM portion of the Caribbean to U.S. Southern Command. That permitted ACOM to focus on joint integration and training to ensure that other CINCs received ready and capable forces. It can easily perform the second function as well.

Title XXX would also propose consolidating all CONUS-based forces under a single command. The commander would hold four star rank and have authority to plan, conduct, and assess joint training. He would also advise CJCS and the Secretary on prioritization of requirements and acquisition programs. His command would develop joint doctrine, concepts and tactics, techniques, and procedures along with an overarching process of joint experimentation. The command would also receive forces from all services for designation as a joint experimentation force. It would develop mission need statements and operational requirements documents for major warfighting platforms. It would also evaluate and integrate products emerging from service experimentation. Such broad authority would allow the commander to view all programs being developed, assess potential successes and failures, prioritize programs based on need, and recommend shifting budgets to accelerate some programs and terminate others.

Senator Coats implies that without such *jointness* DOD will wind up with several partially implemented service approaches and no coherent operational concept. However, he also admitted in a speech in October 1997 that services losing discretion over major investment decisions may be the "ultimate threat of jointness." In an extreme view, the gradual weakening of service authority in the quest for jointness might cause the merging of all services into one. The more the services evolve in that direction, the less diverse they become. Thus the military could lose the strength that is based on the complementary effects of separate service core competencies.

It seems unreasonable to expect to represent every type of force of each service in the new command. With a four star CINC at the helm, substantial forces must be envisioned, a drawback in this resource-constrained era. Assigning forces solely for joint experimentation would enable comprehensive testing and evaluation of joint concepts and future technology but at a price. Currently, all CONUS-based forces can be dual-tasked via the multiple joint strategic capabilities plan apportionment for planning. This implies that they can be used in a variety of scenarios in multiple areas of responsibility. These multiple taskings place a heavy training burden on the forces, necessary because of reduced strength coupled with growing operational requirements.

With operational tempo increasing, assigning forces exclusively for experimentation poses competing demands. The services would have to provide them to JFC while fulfilling operational warfighting requirements. The increased deployment of operational forces will have two impacts. First, those provided to other CINCs will suffer in training and equipment readiness. Both quick turnaround and reduced maintenance cycles mean equipment will wear out faster than it can be replaced. Second, servicemembers will opt for other employment. Fewer units stretched over more and varied missions will result in tired personnel who perform missions to a lower standard. This could mean preventable casualties,

which would draw outside criticism. Disenchantment is already appearing, with low first-term retention across service lines and increased resignation of junior officers who are highly qualified for civilian employment.

Senator Coats addressed three factors driving development when he argued for establishing a JFC: assessment of likely threats/adversaries, technology, and fiscal resources. With these tools he pointed to historical innovations that combined technological advancements with new doctrine and organizations to create more effective capabilities. One example is the evolution of carrier aviation. Although Coats rightly identified the factors that drive development, his historical examples bear little resemblance to current reality.

American development of carrier aviation occurred in an environment in which three factors outlined by Senator Coats that drove development were quantified. Military planners recognized in War Plan Orange that the main adversary would be Japan, so the ability to project power across the Pacific was critical. Also, aircraft and carrier technology had been tested as early as World War I. Our small, isolationist military of the interwar era had a low operational tempo and few immediate requirements, enabling it to look ahead. After Navy planners ran focused experiments in the 1920s and 1930s, they determined on how much support to dedicate to new organizations and matériel.

early adoption of immature technologies could leave the services at a disadvantage as other powers leapfrog ahead

Development strategy today rests on the same factors of threat/adversary, technology, and resources. Potential enemy operational methods are a blank slate. Best guesses pit an advanced force against an asymmetrical, unsophisticated enemy who may reduce technological advantages of U.S. forces. This asymmetry may place the Nation at a handicap. Therefore, the technology to be pursued as a basis for change is unknown. Finally, the realities of today require focusing fiscal resources on operational requirements in a demanding, high operational tempo environment. With so many unknowns, a broad perspective for experimentation is essential.

Evaluating options for joint experimentation means considering myriad factors. Planners should favor the proposal that builds on lessons of past innovation, is best suited to produce joint and synergistic change, and both promotes era A evolution and allows the Armed Forces to exploit era B revolution. They should choose the option that is realistic given current resource constraints. To take the best of both ideals, the preferred direction should approximate the middle of the spectrum. This middle ground solution, according to the ACOM implementation plan, should combine the strengths of both extremes and "implement an aggressive program of experimentation to foster innovation and rapid fielding of new concepts and capabilities for joint operations, and furthermore to evolve our military force through the 'prepare now' strategy for the future." Given these parameters, ACOM is the logical choice as the executive agent for joint experimentation.

The above approach has a number of advantages. Because it is the military's proposal, existing bureaucracies may be more amenable. By channeling the efforts of present organizations, it drains minimum resources from readiness, thus maintaining the U.S. lead during the transformation. By tying into service experimentation organizations, it exploits their existing pool of expertise. By working for a combatant commander, it maintains an operational focus and integrates innovations quickly.

However this approach can fail. It will require commitment from other unified commands. The services must cooperate both with each other and with ACOM to exploit joint experimentation recommendations and create synergy. They must fund and fully support command efforts. It will be easy to treat these initiatives as distractions and marginalize them. The services and unified commands must remember the political pressure for change and recognize that Congress will force a solution on them if this effort fails. Attention to bureaucratic loose ends will be needed. Redundant programs such as the Joint Interoperability Test Center and initiatives such as the commander's interoperability initiative fund need to be eliminated or folded into the ACOM purview.

Some philosophical warnings are also in order. The experimentation must be objective. The answer must not be predetermined. Early adoption of immature technologies could leave the services at a disadvantage as other powers watch the United States and then leapfrog ahead. The year 2010 should not be treated as a hard deadline.

In this era of RMA, it is tempting to join the transformation by jumping in with both feet. Reports from the National Defense Panel indicate that the need to create a transformation process is urgent. Further, the *Quadrennial Defense Review* reported a world of evolving threats including "WMD, information operations, and an array of asymmetric means to exploit our operational vulnerabilities." This bleak future combined with constant pressure to reduce defense spending is

the impetus for demanding drastic change in the way the Armed Forces organize, train, and fight. During an age of technological advances, the desire to embrace the revolution with both hands and accept total change unconditionally is almost overwhelming, as if the military were racing an invisible clock and falling behind. However, a conservative attitude in the midst of a storm could provide the safety mechanism to ensure prudent change rather than reckless pursuit of a concept that may or may not fit national needs.

All the developmental eggs should not be placed in one basket, such as information warfare or directed energy weapons. The Armed Forces must preserve the ability to confront industrial and pre-industrial era threats. It embarked on a search for a silver bullet in the 1950s. The result was the pentomic Army, the all-nuclear Air Force, and a dearth of basic skills to fight technologically inferior opponents on the Korean peninsula and in Southeast Asia.

Finally, technology is not the complete answer. The human dimension is critical in war. Technology must be married to an uncompromising level of intellectual and procedural skill among those who wield it. Military technological innovation must enhance the effectiveness of the joint warrior instead of becoming an end in itself. Appointing ACOM the executive agent for joint experimentation balances insurance against an uncertain future with the requirements of present readiness, thus maximizing the efficiency of the military's most precious resource, its people. **JFQ**

NOTES

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